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# Duration of Flumioxazin-Based Weed Control in Container-Grown Nursery Crops

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Flumioxazin is used in nursery production and landscape maintenance industries. In these situations, weed control provided by flumioxazin often lasts longer than that reported in soil. Our objective was to quantify flumioxazin longevity under conditions found in nursery production. Pots were filled with 6 : 1 (v/v) pine bark : sand mixture. This nonsoil media is typical of what is used for nursery crop production. Pots were treated with flumioxazin at either 0.28 or 0.42 kg ai ha$^{-1}$, and subsequently sown with either hairy bittercress (two winter experiments) or spotted spurge (two summer experiments) at weekly intervals. Weed seed germination, emergence, and seedling establishment in the treated pots was compared with nontreated control and used as a proxy for herbicide activity. Flumioxazin provided approximately 7 wk of complete (100%) hairy bittercress control regardless of rate. However, a rate effect was evident in only one of the two experiments conducted with hairy bittercress. In both experiments with hairy bittercress, marginal and highly variable activity was still evident at 18 wk after treatment. Flumioxazin at 0.28 and 0.42 kg ha$^{-1}$ provided 2- and 4-wk complete spotted spurge control, respectively. No spotted spurge control was evident after about 8 wk. Subjecting this less-variable data to nonlinear regression revealed that the time required for 50% reduction in flumioxazin activity was approximately 5.5 and 6.6 wk for the two rates, respectively. A column leaching study revealed that flumioxazin activity remained localized near the surface (0 to 4 cm). Therefore the dissipation observed was likely the result of in situ degradation and not displacement. The high organic matter content of the nonsoil media contributes to the observed persistence of flumioxazin activity.

**Nomenclature**: Flumioxazin; hairy bittercress, *Cardamine hirsuta* L.; spotted spurge, *Chamaesyce maculata* (L.) Small.
**Key words**: Herbicide leaching, herbicide persistence, ornamental plant production, soil-less growth media.

Flumioxazin se usa en las industrias de producción de almácigos y de mantenimiento de paisajes. En estas situaciones el control de malezas brindado por flumioxazin suele durar más que lo reportado en suelo. Nuestro objetivo fue cuantificar la longevidad de flumioxazin bajo las condiciones que se encuentran en la producción de almácigos. Se llenaron macetas con una mezcla 6:1 (v/v) de corteza de pino:arena. Este medio sin suelo es típico en la producción de almácigos de cultivos. Las macetas fueron tratadas con flumioxazin a 0.28 ó 0.48 kg ai ha$^{-1}$, y subsecuentemente sembradas con *Cardamine hirsuta* (dos experimentos de invierno) o *Chamaesyce maculata* (dos experimentos de verano) en intervalos semanales. Flumioxazin brindó aproximadamente 7 semanas de control completo (100%) de *C. hirsuta* sin importar la dosis. Sin embargo, el efecto de dosis fue evidente solamente en uno de los dos experimentos realizados con esta maleza. En ambos experimentos con *C. hirsuta*, una actividad marginal y altamente variable fue evidente todavía a 18 semanas después del tratamiento. Flumioxazin a 0.28 y 0.42 kg ha$^{-1}$ brindó 2 y 4 semanas de control completo de *C. maculata*, respectivamente. No hubo un control evidente de *C. maculata* después de 8 semanas. Al someter estos datos menos variables a regresión no-lineal, se reveló que el tiempo requerido para reducir en 50% la actividad de flumioxazin fue aproximadamente 5.5 y 6.6 semanas para las dos dosis, respectivamente. Un estudio usando una columna de lixiviación reveló que la actividad de flumioxazin se mantuvo localizada cerca de la superficie (0 a 4 cm). Así, la disipación observada fue probablemente resultado de la degradación in situ y no del desplazamiento del herbicida. El alto contenido de materia orgánica del medio sin suelo contribuye a la persistencia observada de la actividad de flumioxazin.

The herbicide flumioxazin is used in nursery production and landscape maintenance industries, providing both PRE and POST weed control (Altland et al. 2003). It is also registered in soybean and peanut. Flumioxazin inhibits protoporphyrinogen oxidase, an enzyme involved in chlorophyll synthesis (Boger and Wakabayashi 1999; Scalla and Matringe 1994). With respect to its PRE activity, Richardson and Zandstra (2006) evaluated flumioxazin and several other PRE-applied herbicides for weed control in gladiolus (*Gladiolus* spp.) grown for cut flowers. Flumioxazin applied at rates between 0.11 and 0.56 kg ai ha$^{-1}$ provided a favorable balance between comprehensive weed control and minimal crop injury.

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Flumioxazin is reported in the Herbicide Handbook to be "not persistent in soils" (Senseman 2007). This report of limited soil persistence is based upon the laboratory-only research of Ferrell and Vencill (2003). In this research, soil was treated with known amounts of flumioxazin, incubated at 15 and 25 C, and analyzed for flumioxazin over time via solvent extraction and gas chromatographic and mass spectrophotometric detection. The $DT_{50}$ (degradation time for 50% loss of the original amount) was determined to range from only 13 to18 d, depending upon soil type. Dissipation from soil was attributed to microbial activity.

Nursery crop producers in our area have observed that the PRE activity of flumioxazin following the application of registered rates (0.28 to 0.42 kg ha$^{-1}$) typically lasts for more than 30 d. Wehtje et al. (2010) previously evaluated the interaction of flumioxazin and prodiamine when applied as a tank mixture. This study included a dose–response evaluation;